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# PERFORMANCES OF THREE SHORT CYCLED FISH SPECIES IN THE SEASONAL PONDS IN NORTHERN BANGLADESH

**F.M. Shofiquzzoha[1] and D.R. Das**

Bangladesh Fisheries Research Institute
Fresh water Sub-station, Saidpur
Nilphamari 5310, Bangladesh

## Abstract

Cultural trials of short cycled species GIFT (*Oreochromis niloticus*), silver barb (*Barbodes gonionotus*) and Thai koi (*Anabas testudineus*) were carried out during April to June for 120 days in seasonal ponds. GIFT, silver barb and Thai koi fingerlings of 0.93, 0.46 and 0.53 g body weights were stocked at the rate of 45,000/ha in four treatments viz., $T_1$ = GIFT:silver barb:Thai koi at ratio 1:1:1, $T_2$ = silver barb:Thai koi at ratio of 1:1, $T_3$ = GIFT:Thai koi at ratio 1:1 and $T_4$ = GIFT only. The fishes were fed with rice bran, fishmeal, mustard oil cake, wheat bran, wheat flour and vitamin premixes (28.66% protein) at 3-10% body weight twice daily. The mean water temperature was 29.13 ± 0.25°C, DO, 3.81 ± 0.79 mg/l, pH, 7.46 ± 0.12; hardness, 86.42 ± 14.97 mg/l and the transparency, 27.42 ± 2.01cm. The parameters among treatments varied insignificantly. The growth for GIFT, silver barb and Thai koi ranged from 142.0 to 222.5 g, 117.0 to134.0 g and 28.0 to 38.7 g, respectively. The growth of all three species showed better when cultured together in $T_1$. The growth of Thai koi was observed slower while cultured with silver barb. The species wise growth among treatments of Thai koi and silver barb were insignificant, while GIFT was found to be significant. The better performance was observed in three species (GIFT, silver barb and Thai koi) as the ratio 1:1:1, with production 4,260.58 Kg/ha in 120 days with FCR 1.41 and cost benefit ratio of 1:1.32.

## Introduction

Inland aquaculture is the vital source of fish protein of Bangladesh where carp polyculture is the main practice throughout the country. About 1.3 million fishponds in the country, covering an area of 0.305 million ha and about 90.77% were in culture, while about 9.24% were cultivable or derelict (BBS, 2010). However, in the northern districts of Bangladesh about 55% ponds were observed to be seasonal of which 60% retained water for 4-6 months while 40% retained for 6 to 9 months (Haque *et al.* 2008). They reported that the majority of these ponds remained under unplanned fish culture or uncultivated and farmers were less interested due to lower production. Most of the fish farmers practiced very traditional ways and yet to develop the suitable technologies regarding species selectivity and culture management for utilization of such seasonal water bodies. There is great potential to increase fish production through utilizing these existing ponds through concurrent cultural attempts on short cycle species. Many fast growing short cycled fish species *viz.,* GIFT (*Oreochromis niloticus*), Thai koi/climbing perch of Thailand's strain (*Anabas testudinius*) and raj punti/silverbarb (*Barbodes gonionotus*) may have potential (Anon.1998; Haque *et al.* 2008, Adhikary *et al.*, 2009) for culturing scientifically. These short cycled species can be cultured in the seasonal ponds and their hatchery produced seeds are now available. Not much work regarding these species in seasonal ponds has been done in the Northern Bangladesh and data were few or fragmentary. In

this context, the present paper describes the culture trials of these three short cycled species in some selective seasonal ponds.

## Materials and Methods

The experiment was carried out on cultural trials of BFRI GIFT, silver barb and Thai koi in seasonal ponds in Saidpur, Nilphamari during April to July 2009. There were eight ponds selected both from Bangladesh Fisheries Research Institute, Freshwater substation and from the volunteer farmers' each area range of 0.034-0.058 ha. The ponds were prepared by cleaning aquatic vegetation and lime (CaO) was applied at the rate of 125 kg/ha followed by cow dung 500 kg/ha as organic fertilizer and waited for two weeks. The ponds were filled with ground water through pump and applied urea 50 kg/ha and TSP 25 kg/ha and awaited for another week to allow the water to become suitable for stocking. The fish fry of BFRI GIFT was collected from the Freshwater Sub Station, Saidpur; silver barb, from DoF (Department of Fisheries) hatchery of Parbatipur and Thai Koi, from a private hatchery of Santahar, Bogra. GIFT, silver barb and Thai koi fingerlings of 0.93, 0.46 and 0.53g body weight species were stocked at the rate of 45,000/ha with combinations in four treatments, $T_1$ = GIFT: silver barb: Thai koi at ratio 1:1:1, $T_2$ = silver barb: Thai koi at the ratio of 1:1; $T_3$ = GIFT:Thai koi at the ratio of 1:1; and $T_4$ = GIFT only. The fish were fed (approximate 28.66% protein) with a mixture of rice bran (39.9%), fish meal (25%), mustard oil cake (20%), wheat bran (9%), wheat flour (6%) and vitamin premixes (0.1%) at 10% of their body weight twice daily at 10.00 hr and 16.00 hr that gradually decreased fortnightly. Water quality parameters such as temperature, pH, dissolved oxygen (DO), hardness, ammonia, depth and transparency were monitored and recorded weekly, while growth of the fishes were monitored every fortnightly by using cast net. Finally fishes were harvested by dewatering the ponds. Data were compiled and growth and production was estimated quantitatively and analyzed statistically. The net profit was estimated by calculating the gross return deducts from total variable cost (TVC). However, TVC was considered by including cost of land tenure/6 month, lime and fertilizers, fencing for Thai koi to prevent escaping, fish seed and feed ingredients. Besides cost benefit ratio (CBR) analysis was done as Morrice (1998).

## Results and Discussion

Water quality parameters of different treatments *i.e.*, water temperature, pH, DO, hardness, ammonia, depth and transparency are shown in Table 1. No significant variation was observed in the treatments except transparency. The mean water temperature was remained 29.13 ± 0.25°C. Suitable range of water temperature was suggested by Mumtazuddin *et al.* (1982) and Rahman *et al.* (1982) to be 20.5-36.5°C. The mean value of pH was 7.46 ± 0.12 in the treatments that were suitable and agreed with Azim *et al.* (1995) and Kohinoor *et al.* (1998). DO was recorded to be 3.81 ± 0.79 mg/l during the period. The range was seemed to be lower, however, it agreed with Rahman *et al.* (1982) and Nirod (1997) who found the range within 2.2 to 8.79 mg/l. The mean content of ammonia was 0.69 ± 0.48 mg/l that seemed to be higher. Hardness was 86.42 ± 14.97 mg/l that seemed to be lower during the experimental ponds. However, Mollah and Haque (1978) mentioned the suitable range of ammonia to be 0.2-0.9 mg/l and hardness, 95-250 mg/l while Rahman (1992) indicated the range to be 0.4-1.5 ppm and 75-200 ppm of ammonia and hardness, respectively. The water transparency was observed to be 27.42 ± 2.01 cm that varied significantly ($P<0.05$) among treatments and were within optimal

range and that was agreed with Mumtazuddin *et al.* (1982) and Azim *et al.* (1995). Khan and Siddiquee (1974) also reported that the turbidity and phytoplankton affected the transparency of pond waters while Reid and Wood (1976) stated that the transparency of water was affected by the factors such a silting, microscopic organisms, suspended organic matter, latitude, season and intensity of incident light. However, in the present experiment, the major water quality parameters among treatments varied insignificantly and suitable for fish culture.

**Table 1.** Water quality parameters of different treatments during the period of experiment

| Parameters | Treatment mean | | | | Mean | Statistical Inference |
|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | | |
| Water temp. ($^0$C) | 29.03±1.93 | 29.35±2.13 | 29.83±2.48 | 29.13±2.48 | 29.13±0.25 | NS[1] |
| pH | 7.56±0.30 | 7.31±0.27 | 7.55±0.32 | 7.40±0.49 | 7.46±0.12 | NS |
| DO[2] (mg/l) | 4.03±1.14 | 3.88±0.87 | 3.97±0.90 | 3.35±0.97 | 3.81±0.79 | NS |
| Hardness (mg/l) | 90.67±19.35 | 64.25±35.02 | 96.50±29.28 | 94.25±31.71 | 86.42±14.97 | NS |
| Ammonia (mg/l) | 0.29±0.13 | 0.43±0.33 | 0.73±0.62 | 1.31±0.82 | 0.69±0.48 | NS |
| Water depth (cm) | 80.70±13.97 | 86.50±17.92 | 97.85±22.07 | 80.70±13.97 | 83.83±20.27 | NS |
| Transparency (cm) | 25.05±5.03 | 28.45±4.48 | 31.80±4.61 | 24.38±3.87 | 27.42±2.01 | S[3] |

2= Dissolved Oxygen, 1=Not significant, 3=Significant ($p<0.05$)

Comparative growths of three species among treatments are shown in Fig. 1(a-c). Growth of all three species showed better when cultured together. Thai koi showed better growth when cultured with silver barb and GIFT, followed by combination with GIFT. The growth of Thai koi was observed to be slower while cultured with silver barb only (Fig. 1a).

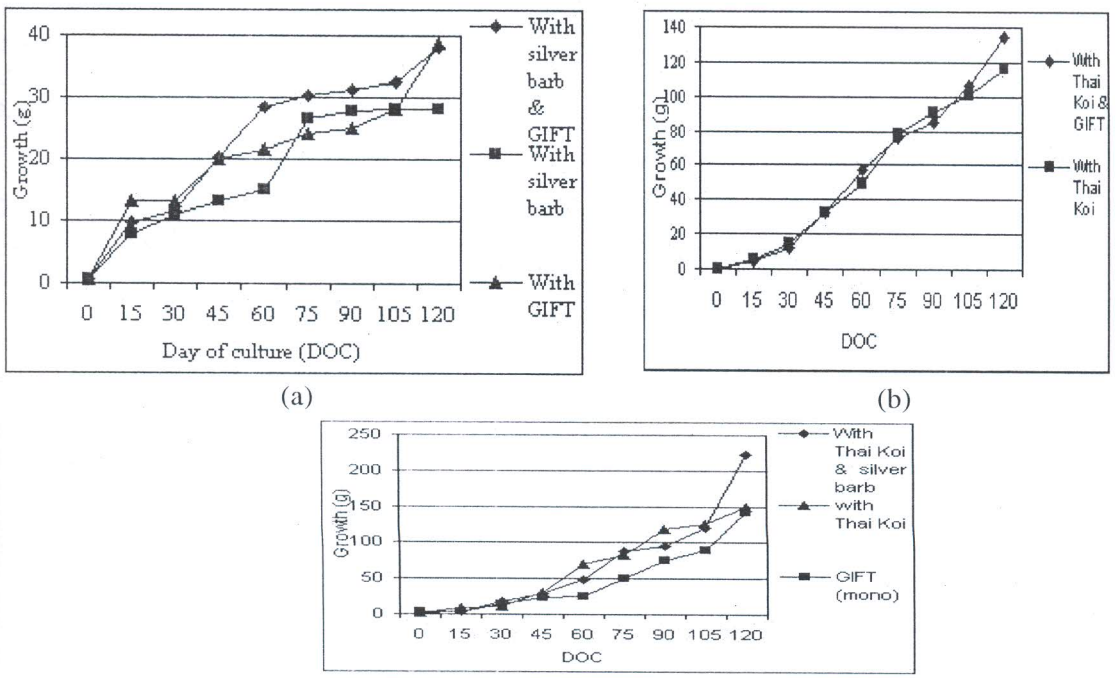


**Fig. 1.** Comparative growth of (a) Thai koi, (b) silver barb and (c) GIFT in treatments.

The species wise growth of Thai koi and silver barb among treatments was varied insignificantly; while the growth of GIFT was significant ($P<0.01$) among treatments (Table 2). The average final growth recorded for Thai koi was 38.00 ± 2.37, 28.00 ± 10.25 and 38.70 ± 9.25 g in the treatment $T_1$, $T_2$ and $T_3$, respectively and for silver barb, 134.00 ± 14.37 and 117.00 ± 15.83 g in the treatment $T_1$ and $T_2$, respectively. For GIFT the growth was 222.50 ± 39.78, 148.50 ± 36.66 and 142.00 ± 24.52 g in the treatment $T_1$, $T_3$ and $T_4$, respectively (Table 2). Siddik and Khan (2008) reported the average growth 112.40 ± 0.36 g for GIFT after 180 days of culture. The survival was determined from recovery of fishes at the end of the experiment and the survival rates were recorded for Thai koi to be 65.53 ± 10.01, 63.93 ± 12.05 and 66.73 ± 3.23% in $T_1$, $T_2$ and $T_3$, respectively which were lower than of other two species, GIFT and silver barb. Survival rates of GIFT was 75.87 ± 0.45, 78.44 ± 1.88 and 71.33 ± 1.97% in $T_1$, $T_3$ and $T_4$, respectively while for silver barb, they were 67.40 ± 0.53 and 76.19 ± 3.20% in $T_1$ and $T_2$, respectively (Table 2). The lower survival of Thai koi might be due to predation or severe escaping by nature. However, survival rates of the three species were similar as reported by Shah *et al.* (1998), Begum *et al.* (2003), Ahmed and Khair (2007) and Adhikary *et al.* (2009).

The specific growth rate (SGR%) was estimated for Thai koi to be 4.17, 3.86 and 4.18 in $T_1$, $T_2$ and $T_3$, respectively and for silver barb to be 5.56 and 5.42 in $T_1$ and $T_2$, respectively. For GIFT, they were 5.47, 5.07 and 5.02 in $T_1$, $T_3$ and $T_4$, respectively (Table 2). The obtained SGR (%) was similar to Shah *et al.* (1998), Begum, *et al.* (2003) and Adhikary *et al.* (2009). Comparatively slower growth rate was recorded in Thai koi in comparison to silver barb in $T_2$ which might be attributed to the higher stocking density as well inter and intra-specific dietary overlap between the two fishes. Mostakim *et al.* (2001) stated that the feeding patterns in respect of quality and quantity of food of silver barb varied with their size development. Haroon and Pittman (2000) reported that, interspecific dietary width was relatively broader for *B. gonionotus* than *Oreochromis* sp. as well as, intraspecific dietary overlap was also broad between sizes of tilapia.

In the present study, apparently higher production of 4,260.59 kg/ha/120days was recorded in $T_1$ (Table 2). This production was similar with Begum *et al.* (2003) and Ahmed and Khair (2007). Feed conversion ratio (FCR) was calculated as 1.41, 1.87, 1.85 and 1.61 for $T_1$, $T_2$, $T_3$ and $T_4$, respectively which were similar to Miah *et al.* (1993) and Mazid *et al.* (1997).

**Table 2.** Growth, survival and food conversion ratios of fishes in different treatments in ponds (120 days)

| Treatment | Species | Pond's area (ha) | Stocking /ha | Initial weight (g) | Final weight (g) | Survival (%) | SGR (%) | Production (kg/ha) | Total prod. kg/ha | FCR |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | Thai Koi | 0.058 | 15000 | 0.53±0.32 | 38.00±2.37 | 65.53±10.01 | 4.17 | 372.89 | 4260.59 | 1.41 |
| | silver barb | | 15000 | 0.46±0.18 | 134.00±14.37 | 67.40±0.53 | 5.56 | 1355.58 | | |
| | GIFT | | 15000 | 0.93±0.23 | 222.50±39.78[a] | 75.87±0.45 | 5.47 | 2532.11 | | |
| $T_2$ | Thai Koi | 0.050 | 22500 | 0.53±0.32 | 28.00±10.25 | 63.93±12.05 | 3.86 | 397.75 | 2394.89 | 1.87 |
| | silver barb | | 22500 | 0.46±0.18 | 117.00±15.83 | 76.19±3.20 | 5.42 | 1997.14 | | |
| $T_3$ | Thai Koi | 0.039 | 22500 | 0.53±0.32 | 38.70±9.25 | 66.73±3.23 | 4.18 | 583.22 | 3205.27 | 1.85 |
| | GIFT | | 22500 | 0.92±1.57 | 148.50±36.66[b] | 78.44±1.88 | 5.07 | 2622.05 | | |
| $T_4$ | GIFT (mono) | 0.034 | 45000 | 0.92±1.57 | 142.00±24.52[b] | 71.33±1.97 | 5.02 | 4551.89 | 4551.89 | 1.61 |

The calculated net profit in 120 days was higher in $T_1$ (Tk. 96,239.85 /ha) followed by $T_3$ (Tk. 36,087.43 /ha) and $T_4$ (Tk. 35,239.51 / ha) while return obtained was negative in treatment $T_2$ (Tk. -21,012.52/ ha) were a combination of Thai koi and silver barb (Table 3). The calculated CBR was 1:1.32, 1:0.91, 1:1.13 and 1:1.12 in the treatment $T_1$, $T_2$, $T_3$ and $T_4$ respectively (Table 3).

**Table 3.** Total variable cost, gross margin, net profit and the cost ratio benefit in different treatments of seasonal ponds

| Treatments | Variable Cost (Tk./ha) | Gross return (Tk./ha) | Net profit (Tk./ha) | Cost benefit ratio |
|---|---|---|---|---|
| T1 | 2,96,639.59 | 3,92,879.43 | 96,239.85 | 1:1.32 |
| T2 | 2,30,460.27 | 2,09,447.75 | -21,012.52 | 1:0.91 |
| T3 | 2,92,044.84 | 3,28,132.26 | 36,087.43 | 1:1.13 |
| T4 | 3,15,502.13 | 3,50,741.64 | 35,239.51 | 1:1.12 |

From the results of the experiment it could be said that the polyculture of Thai koi, silver barb and GIFT could be possible in seasonal ponds potentially in northern region. The better performance was observed in three species ratio of 1:1:1, with production of 4,260.58 Kg/ha in120 days with FCR 1.41 while the calculated cost benefit ratio was 1:1.32. However, environment of seasonal ponds could be suitable for other indigenous short cycled species like *Clarias sp., Heteropneustes sp.* but further research can be done.

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**References**

Adhikary, R.K., Z.B. Mostafa, A. Saha and M.S. Shah. 2009. Growth performance of Thai koi (*Anabas testudineus*) in integrated culture system. *Bangladesh Res. Pub. J.*, **2** (1): 361-370.

Ahmed, M.T. and M.A. Khair, 2007. Commercial culture of Koi fish. A compendium on fish fortnight 16-30 July: *Conservtion and extention movement for indigenous fish species*, (in Bangla). Department of Fisheries, Ministry of fisheries and Livestock. Bangladesh, 51-52 p.

Anonymous, 1998. Dissemination and evaluation of genetically improved tilapia species in Asia (DEGITA). Final report. The International Center for Living Aquatic Resources Management (ICLARM). pp 151.

Azim, M.E., G.S. Talukder, M.A.Wahab, M.M. Haque and M.S. Haq. 1995. Effect of liming and maintenance of total hardness levels on fish production in fertilized ponds. *Progress. Agric.*, **6** (2): 7-14

BBS, 2010. Bangladesh Bureu of Statistics. *Statstical Year Book 2010 of Bangladesh*. Planning division. Ministry of Planning. Dhaka, Bangladesh. 538 p.

Begum, A., G. Mustafa and K. Ahmed. 2003. Studies on the limnology in mini pond and growth of tilapia (*Oreochromis niloticus*). *Bangladesh J. Zool.*, **17** (1): 35-40.

Haroon, A.K.Y. and K.A. Pittman. 2000. Niche measures and feeding strategies of *Barbodes gonionotus* Bleeker and *Oreochromis* spp. from a rice field in Bangladesh. *Bangladesh J. Fish. Res.*, **4** (1): 13-26

Huque, S.H.E., G.S. Hossain and K.A. Huq. 2008. Effect of stocking density on growth performance of Thai koi (*Anabas testudineus*) monoculture. Bangladesh Fisheries Research Forum (BFRF). Abstracts Book. 3rd Fisheries Conference and Research Fair 2008. Bangladesh Agricultural Research Council, Dhaka, Bangladesh. 170 p.

Khan, R.A. and A.Q. Siddiquee. 1974. Seasonal changes in the limnology of a seasonal fish pond at Aligarh. *Indian J. Fish.*, **21** (2): 463-478.

Kohinoor, A.H.M., M.L. Islam, M.A. Wahab and S.H. Thilsted. 1998. Effect of mola (*Amblypharyngodon molaI*, Ham.) on growth and production of short cycled species culture in miniponds. Bangladesh. *J. Fish. Res.*, **2** (2): 119-126.

Mazid, M.A., M. Zaher, N.N. Begum, M.Z. Ali, and F. Nahar. 1997. Formulation of cost effective feeds from locally available ingredients for carp polyculture systems for increased production. *Aquaculture*, **151**:71-78.

Miah, M.S., M. Shahabuddin and M.S. Shah. 1993. Effect of supplementary feed in carps monoculture systems. *Bangladesh. J. Agril. Sci.*, **20** (2): 359-364.

Mollah, M.F.A. and A.K. M.A. Haque. 1978. Studies on monthly variations of plankton in relation to the physico-chemical conditions of water and bottom soil of two ponds. II. Zooplankton. *Bangladesh J. Fish.*, **1** (2): 99-103.

Mumtazuddin, M., M.S. Rahman and G. Mostafa. 1982. Limnological studies of four selected ponds at the aquaculture experiment station. Mymensingh. *Bangladesh. J. Fish.*, **2-5**: 83-90.

Morrice, C.P. 1998. A trial to test the suitability of a low-input cost, silver barb (*Puntius gonionotus*) – based, polyculture model for seasonal ponds in Northwest Bangladesh. *Asian Fish. Sc.* Asian Fisheries Society, Manila, Philippines. **11**: 121-132.

Mostakim, M., M.S. Islam, M.K. Rahman and S.M. Rahmatullah. 2001. Size related feeding patterns and electively indices of silver barb (*Barbodes gonionotus* Bleeker) from a pond, Bangladesh. *Bangladesh J. Fish. Res.*, **5** (2) : 105-114.

Nirod, D.B. 1997. Effect on stocking density on the growth and production of GIFT (*Oreochromis* sp.) and Thai koi (*Anabas* sp.). M. S. Thesis submitted to the Department of Fisheries Management, Bangladesh Agricultural University, 75p.

Rahman, M.S., M.Y. Chowdhury, A.K. M.A. Haque and M.S. Haq. 1982. Limnological studies of four ponds. *Bangladesh. J. Fish.*, **2-5** (1-2): 25-35.

Rahman, M.S. 1992. Water quality management in aquaculture. BRAC Prokashana, 66, Mohakhali, Dhaka-1212, Bangladesh, 84 p.

Reid, G.K., and R.D. Wood, 1976. Ecology of inland water and estuaries. 2nd. Ed. D. van. Nostrand Co. New York, 477p.

Shah, A.K.M.A, M.A. Hossain and K. Afsana. 1998. Effect of different rice brans on the growth of Thai silver barb (*Puntius gonionotus* Bleeker) in seasonal ponds.*Bangladesh. J. Fish.*, **2-2** (2): 159-169.

Siddik, M.A.B. and M.M.R. Khan. 2008. Over-wintering growth performance of GIFT and monosex tilapia (*Oreochromis Niloticus* L.) in seasonal ponds. Bangladesh Fisheries Research Forum (BFRF). *Abstracts Book. 3rd Fisheries Conference and Research Fair 2008.* Bangladesh Agricultural Research Council, Dhaka, Bangladesh. 170 p.